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MORTALITY OF ENGELMANN SPRUCE BARK BEETLE BROOD
WINTER OF 1955-1956
NORTHERN ROCKY MOUNTAIN REGION

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During the period of November 11-17, 1955 an abnormal weather condition occurred in western Montana and northern Idaho (table 1). Temperatures dropped to record lows for November in many places and daily minimum temperatures reached sub-zero readings for several successive days. Speculation developed among foresters regarding the effect of the unseasonal temperatures on bark beetle brood, particularly broods of the Engelmann spruce beetle, an insect responsible for the loss of over two billion board feet of spruce in the region during the past four years.

As a check of possible beetle mortality samples of spruce beetle infested tree bole were collected by the Forest Insect Laboratory December 9, 1955 from the Hoodoo Creek drainage on the Lolo National Forest. The mortality of the brood in these samples was 84 percent, sufficiently high to indicate the possibility of wide-spread mortality throughout the spruce beetle outbreak area in the northern Rocky Mountain Region.

Requests by the Laboratory were made for additional samples of infested material from selected points in the region. These were collected by national forest personnel from logging areas and were brought into the Laboratory for checking. The results of this survey show a very high degree of brood mortality from nearly all of the areas sampled (table 2).

Past experience has shown that "winter mortality" of bark beetle brood is a very important factor in their life history and in the outbreak cycle of bark beetle epidemics. The various stages of the Engelmann spruce beetle seem to be quite susceptible to low temperatures. Winter-caused mortality of Engelmann spruce beetle brood in the winter of 1953-1954[1/] is believed to be one of the factors in the decline of the outbreak which built up rapidly in 1953 but decreased in 1954.

1/ Terrell, Tom T. Mortality of Engelmann spruce beetle brood during the winter of 1953-1954. Research Note 10. Intermountain Forest and Range Experiment Station, U. S. Forest Service, Ogden, Utah. 9 pp. (Processed)

Laboratory and field observations have shown that bark beetle resistance to low temperatures increases with the advent of normal cold weather in the fall and decreases with the coming of spring. Although some mortality apparently occurs every winter, because winter in these latitudes is a severe test, most of the bark beetles are capable of withstanding the lowest normal temperatures occurring in the region. Preparation for winter seems to be an involved cell-chemical change in which the insects expel free water and increase the fatty content. Such a change is not quickly accomplished; it seems to require an extended period as is experienced during a normal fall.

While the insects have developed a process by which to survive the normal fall and winter they cannot anticipate or cope with severe abnormal or unseasonal temperature variations. Thus, any unusual drop in temperature may be expected to cause a degree of mortality. Conditions causing abnormal mortality are, (1) unusually low fall or spring temperatures, (2) unusually low winter temperatures, and (3) normally low winter temperatures preceded by abnormally high winter temperatures. These weather changes, or variations of them, create conditions to which the insects are not adapted.

The brood mortality which occurred in the winter of 1953-1954 was brought about by a sudden temperature drop in January that was preceded by unusually warm weather. At that time somewhat higher mortality occurred at lower elevations (which seem to have the lowest temperatures and the widest variations). The current brood mortality seems to be less in the drainage bottoms as evidenced by the collections from American Creek and from Canuck Creek (table 2). The two samples from Canuck Creek illustrate this point: The sample taken at 4,800 feet elevation was from the drainage bottom while the 5,200 foot sample was from higher up the slope.

This reversal in the degree of mortality between lower and higher elevations to that experienced in 1953-1954 is believed to be due to a difference in the "tempering" of the brood. Characteristically, drainage bottoms are more frosty in the fall than the slopes. This would induce an earlier conditioning of the brood along the creeks than on the slopes. In 1953-1954, winter preparation had probably reached the same degree by mid-January for all beetle broods. The noticeably greater mortality in 1953-1954 at lower elevations was probably due simply to a somewhat lower temperature at the lower elevations.

The current degree of Engelmann spruce beetle brood mortality is gratifying and will doubtless further the decline in the epidemic trend recorded in 1954 and 1955.

Table 1.--Maximum and minimum temperatures from weather bureau stations in Montana and Idaho

November 1955

Station		Day of the month: 10	11	12	13	14	15	16	17	18	19	20
Superior, Mont.	Max.	57	44	26	12	12	10	10	13	26	38	36
	Min.	41	25	3	-1	-5	-6	-14	-1	10	24	31
Hungry Horse Dam, Mont.	Max.	49	28	1	4	0	4	4	7	20	42	36
	Min.	27	-1	-5	-6	-4	-5	-7	-5	7	20	27
Polebridge, Mont.	Max.	49	32	4	0	2	4	7	10	25	39	36
	Min.	27	4	-13	-18	-10	-10	-24	26	4	24	26
Avery, Idaho	Max.	54	45	28	20	18	19	16	22	31	34	36
	Min.	40	28	10	0	10	-3	-7	9	19	31	34
Porthill, Idaho	Max.	51	42	12	14	12	14	15	14	21	43	39
	Min.	34	11	-3	-11	0	-12	-15	-12	10	20	20

Table 2.--Mortality of Engelmann spruce beetle brood at selected points in the Northern Rocky Mountain Region during the winter of 1955-1956

Forest and drainage	Elevation	Insects in sample	Living			Dead			Percent dead	Parasites & Predators			
			Larvae	Pupae	Adults	Larvae	Pupae	Adults		Total	Living	Dead	Percent dead
Lolo Natl.Forest,Mont. Hoodoo Creek	5,500	254	34	0	6	138	22	54	84	26	14	12	46
Flathead Natl.For.,Mont Lost Johnny Creek	--	131	8	0	2	66	0	55	92	4	4	0	0
Flathead Natl.For.,Mont Upper Hay Creek	6,000	193	0	0	0	176	0	17	100	3	1	2	67
Kaniksu Natl.For.,Mont. American Creek1/	4,900	217	121	0	2	77	2	15	43	0	0	0	0
St.Joe Natl.For.,Idaho East Fk.,Fishhook Cr.	4,700	415	31	0	41	235	0	108	83	82	60	22	27
Kaniksu Natl.For.,Ida. Canuck Creek1/	4,800	300	71	0	1	169	0	59	76	3	1	2	67
Kaniksu Natl.For.,Ida. Canuck Creek	5,200	101	0	0	0	63	0	38	100	1	1	0	0
Totals and averages		1,611	265	0	52	924	24	346	80	119	81	38	32

1/ Drainage bottom samples

Table 2.--Mortality of Engelmann spruce beetle brood at selected points in the Northern Rocky Mountain Region during the winter of 1955-1956

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Totals and averages		1,611	265	0	52	924	24	346	80	119	81	38	32

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